

Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland.—The Wild Glossina morsitans Strain.

By Surgeon-General Sir DAVID BRUCE, C.B., F.R.S., A.M.S.; Majors DAVID HARVEY and A. E. HAMERTON, D.S.O., R.A.M.C.; and Lady Bruce, R.R.C

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Introduction.

These strains were obtained by bringing tsetse flies (*Glossina morsitans*) to the laboratory from the neighbouring "fly-country" and at once allowing them to feed on healthy animals. The term "wild" is used to distinguish these caught flies from flies bred in the laboratory. The first strain was obtained by feeding the flies on a monkey, the remaining four by feeding on dogs. As soon as the healthy animal was found to be infected other animals were inoculated from it. But, as in the case of the Wild-game strains, only trypanosomes from a single rat were used for purposes of measurement and comparison.

I. *Morphology of Strain I, Wild Glossina morsitans.*

The following table gives the average length of this trypanosome as found in the rat, 500 trypanosomes in all, and also the length of the longest and shortest.

Table I.—Measurements of the Length of the Trypanosome of Strain I, Wild *Glossina morsitans*.

Date.	Method of fixing.	Method of staining.	In microns.		
			Average length.	Maximum length.	Minimum length.
1912	Osmic acid	Giemsa	22·7	34·0	16·0

Table II.—Distribution in respect to Length of 500 Individuals of the Trypanosome of Strain I, Wild *Glossina morsitans*.

	In microns.									
	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
Total	3	11	25	56	62	75	53	31	28	44
Percentages	0·6	2·2	5·0	11·2	12·4	15·0	10·6	6·2	5·6	8·8

	In microns.									
	26.	27.	28.	29.	30.	31.	32.	33.	34.	
Total	16	23	26	22	12	6	4	1	2	
Percentages	3·2	4·6	5·2	4·4	2·4	1·2	0·8	0·2	0·4	

CHART 1.—Curve representing the Distribution, by Percentages, in respect to Length, of 500 Individuals of the Trypanosome of Strain I, Wild *Glossina morsitans*, taken on nine consecutive days from Rat 655.

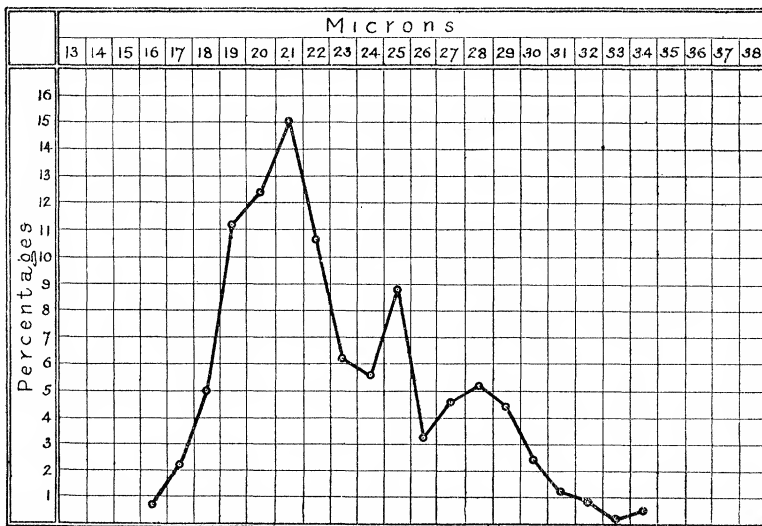


Table III.—Percentage of Posterior-nuclear Forms found among the Short and Stumpy Varieties of the Trypanosome of Strain I, Wild *Glossina morsitans*.

Date.	Experiment No.	Animal.	Percentage among short and stumpy forms.
1912			
June 18	655	Rat	6
„ 19	655	„	10
„ 20	655	„	11
„ 21	655	„	17
„ 22	655	„	0
„ 24	655	„	16
„ 25	655	„	28
„ 26	655	„	26
„ 27	656	„	23
„ 28	655	„	0
„ 29	655	„	7
„ 30	655	„	4
Average			12·3

II. *Morphology of Strain II, Wild Glossina morsitans.*

The following table gives the average length of this trypanosome as found in the rat, 500 trypanosomes in all, and also the length of the longest and shortest.

Table IV.—Measurements of the Length of the Trypanosome of Strain II, Wild *Glossina morsitans*.

Date.	Method of fixing.	Method of staining.	In microns.		
			Average length.	Maximum length.	Minimum length.
1912	Osmic acid	Giemsa	24·5	34·0	17·0

Table V.—Distribution in respect to Length of 500 Individuals of the Trypanosome of Strain II, Wild *Glossina morsitans*.

	In microns.								
	17.	18.	19.	20.	21.	22.	23.	24.	25.
Total	1	4	20	43	67	44	48	34	42
Percentages	0·2	0·8	4·0	8·6	13·4	8·8	9·6	6·8	8·4

	In microns.								
	26.	27.	28.	29.	30.	31.	32.	33.	34.
Total	35	33	43	28	23	19	13	2	1
Percentages	7·0	6·6	8·6	5·6	4·6	3·8	2·6	0·4	0·2

CHART 2.—Curve representing the Distribution, by Percentages, in respect to Length, of 500 Individuals of the Trypanosome of Strain II, Wild *Glossina morsitans*, taken on nine consecutive days from Rat 656.

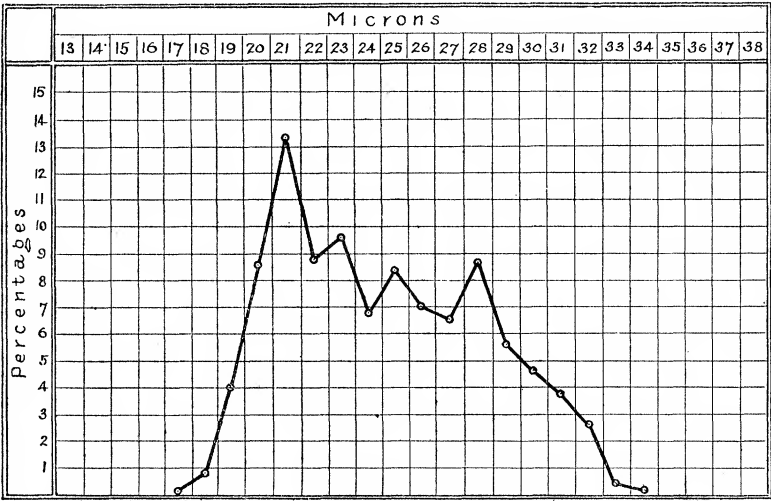


Table VI.—Percentage of Posterior-nuclear Forms found among the Short and Stumpy Varieties of the Trypanosome of Strain II, Wild *Glossina morsitans*.

Date.	Experiment No.	Animal.	Percentage among short and stumpy forms.
1912			
June 17	656	Rat	8
" 18	656	"	12
" 19	656	"	13
" 20	656	"	22
" 21	656	"	43
" 22	656	"	44
" 24	656	"	27
" 25	656	"	28
" 26	656	"	45
" 27	656	"	47
Average			28.9

III. *Morphology of Strain III, Wild Glossina morsitans.*

The following table gives the average length of this trypanosome as found in the rat, 500 trypanosomes in all, and also the length of the longest and shortest.

Table VII.—Measurements of the Length of the Trypanosome of Strain III, Wild *Glossina morsitans*.

Date.	Method of fixing.	Method of staining.	In microns.		
			Average length.	Maximum length.	Minimum length.
1912	Osmic acid	Giemsa	20.5	31.0	16.0

Table VIII.—Distribution in respect to Length of 500 Individuals of the Trypanosome of Strain III, Wild *Glossina morsitans*.

	In microns.							
	16.	17.	18.	19.	20.	21.	22.	23.
Total	19	72	84	85	44	24	40	33
Percentages	3·8	14·4	16·8	17·0	8·8	4·8	8·0	6·6

	In microns.							
	24.	25.	26.	27.	28.	29.	30.	31.
Total	27	18	21	12	11	3	4	3
Percentages	5·4	3·6	4·2	2·4	2·2	0·6	0·8	0·6

CHART 3.—Curve representing the Distribution, by Percentages, in respect to Length, of 500 Individuals of the Trypanosome of Strain III, Wild *Glossina morsitans*, taken on nine consecutive days from Rat 657.

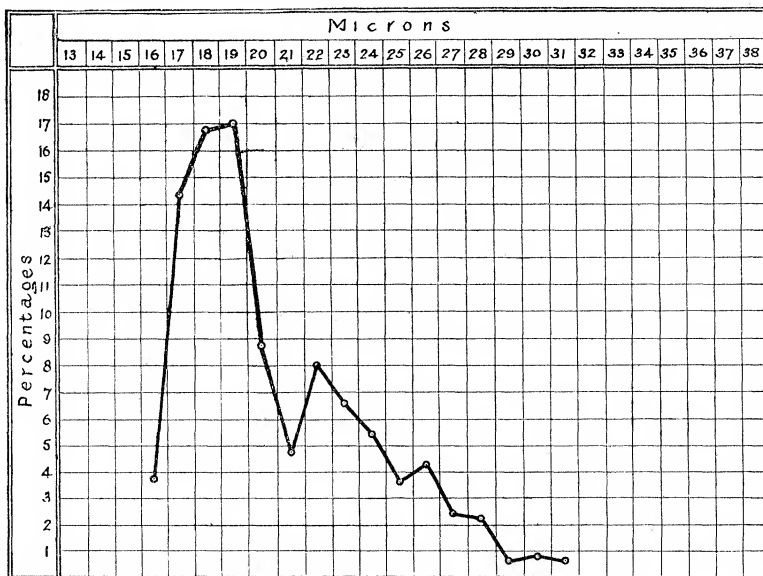


Table IX.—Percentage of Posterior-nuclear Forms found among the Short and Stumpy Varieties of the Trypanosome of Strain III, Wild *Glossina morsitans*.

Date.	Experiment No.	Animal.	Percentage among short and stumpy forms.
1912.			
June 17	657	Rat	4
" 18	657	"	9
" 19	657	"	13
" 20	657	"	4
" 21	657	"	2
" 22	657	"	15
" 24	657	"	32
" 25	657	"	18
" 26	657	"	4
" 27	657	"	27
Average			12·8

IV. *Morphology of Strain IV, Wild Glossina morsitans.*

The following table gives the average length of this trypanosome as found in the rat, 500 trypanosomes in all, and also the length of the longest and shortest.

Table X.—Measurements of the Length of the Trypanosome of Strain IV, Wild *Glossina morsitans*.

Date.	Method of fixing.	Method of staining.	In microns.		
			Average length.	Maximum length.	Minimum length.
1912	Osmic acid	Giemsa	22·7	34·0	15·0

Table XI.—Distribution in respect to Length of 500 Individuals of the Trypanosome of Strain IV, Wild *Glossina morsitans*.

	In microns.									
	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
Total	1	5	37	60	71	54	34	25	17	13
Percentages	0·2	1·0	7·4	12·0	14·2	10·8	6·8	5·0	3·4	2·6

	In microns.									
	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.
Total	15	19	34	30	31	30	8	14	1	1
Percentages	3·0	3·8	6·8	6·0	6·2	6·0	1·6	2·8	0·2	0·2

CHART 4.—Curve representing the Distribution, by Percentages, in respect to Length, of 500 Individuals of the Trypanosome of Strain IV, Wild *Glossina morsitans*, taken on nine consecutive days from Rat 658.

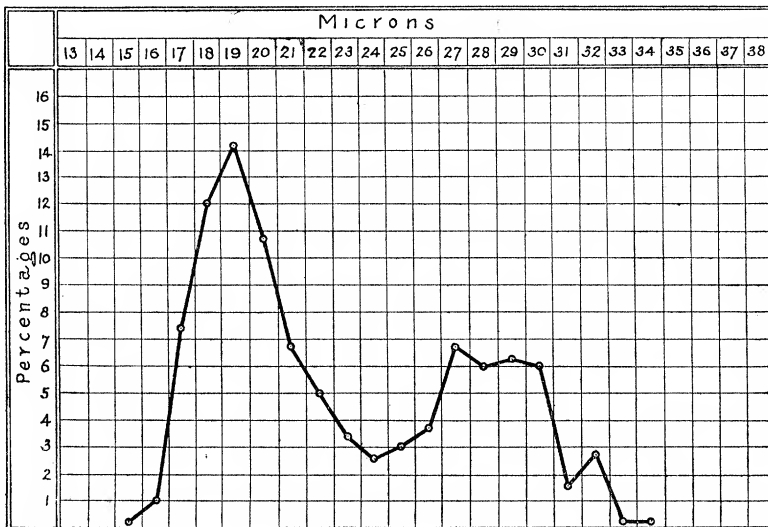


Table XII.—Percentage of Posterior-nuclear Forms found among the Short and Stumpy Varieties of the Trypanosome of Strain IV, Wild *Glossina morsitans*.

Date.	Experiment No.	Animal.	Percentage among short and stumpy forms.
1912.			
June 17	658	Rat	0
" 18	658	"	0
" 19	658	"	6
" 21	658	"	16
" 22	658	"	9
" 24	658	"	7
" 25	658	"	7
" 26	658	"	8
" 27	658	"	0
" 28	658	"	10
" 29	658	"	0
July 1	658	"	0
" 2	658	"	0
" 3	658	"	0
Average.....			4·5

V. *Morphology of Strain V, Wild Glossina morsitans.*

The following table gives the average length of this trypanosome as found in the rat, 500 trypanosomes in all, and also the length of the longest and shortest:—

Table XIII.—Measurements of the Length of the Trypanosome of Strain V, Wild *Glossina morsitans*.

Date.	Method of fixing.	Method of staining.	In microns.		
			Average length.	Maximum length.	Minimum length.
1912	Osmic acid	Giemsa	22·8	35·0	15·0

Table XIV.—Distribution, in respect to Length, of 500 Individuals of the Trypanosome of Strain V, Wild *Glossina morsitans*.

	In microns.									
	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
Total	6	4	27	57	94	49	37	22	14	13
Percentages	1·2	0·8	5·4	11·4	18·8	9·8	7·4	4·4	2·8	2·6

	In microns.										
	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.
Total	11	19	25	23	29	27	18	13	7	3	2
Percentages	2·2	3·8	5·0	4·6	5·8	5·4	3·6	2·6	1·4	0·6	0·4

CHART 5.—Curve representing the Distribution, by Percentages, in respect to Length, of 500 Individuals of the Trypanosome of Strain V, Wild *Glossina morsitans*, taken on nine consecutive days from Rat 660.

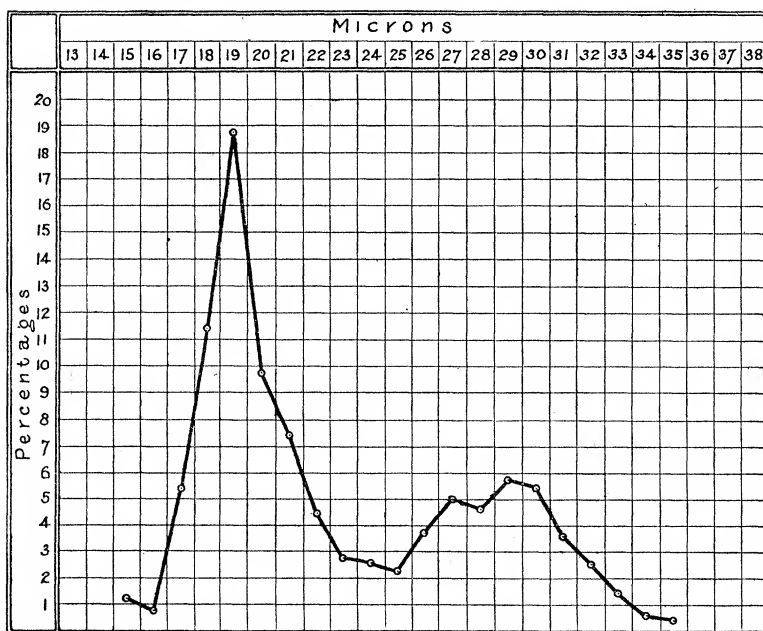


Table XV.—Percentage of Posterior-nuclear Forms found among the Short and Stumpy Varieties of the Trypanosome of Strain V, Wild *Glossina morsitans*.

Date.	Experiment No.	Animal.	Percentage among short and stumpy forms.
1912.			
June 18	660	Rat	0
„ 19	660	„	0
„ 20	660	„	0
„ 21	660	„	8
„ 22	660	„	19
„ 24	660	„	0
„ 25	660	„	6
„ 26	660	„	4
„ 27	660	„	6
„ 28	660	„	6
„ 29	660	„	2
July 2	660	„	2
„ 3	660	„	1
Average			4·2

Comparison of the Wild Glossina morsitans Strains with one another.

Table XVI.—Measurements of the Length of the Trypanosome of the Wild *Glossina morsitans* Strains.

Date.	Expt. No.	Animal.	Number measured.	From what animals.	In microns.		
					Average length.	Maximum length.	Minimum length.
1912	523	Monkey	500	Rat	22·7	34·0	16·0
1912	542	Dog	500	„	24·5	34·0	17·0
1912	551	„	500	„	20·5	31·0	16·0
1912	595	„	500	„	22·7	34·0	15·0
1912	602	„	500	„	22·8	35·0	15·0
			2500	Average...	22·6	35·0	15·0

Table XVII.—Distribution in respect to Length of 2500 Individuals of the Trypanosome of the five Wild *Glossina morsitans* Strains.

	In microns.									
	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
Total.....	7	31	148	230	326	252	237	184	143	115
Percentages	0·3	1·2	5·9	9·2	13·1	10·1	9·5	7·3	5·7	4·6

	In microns.										
	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.
Total.....	130	110	127	133	113	96	54	44	11	7	2
Percentages	5·2	4·4	5·1	5·3	4·5	3·8	2·2	1·8	0·4	0·3	0·1

CHART 6.—Curve representing the Distribution, by Percentages, in respect to Length, of 2500 Individuals of the Trypanosome of the Wild *Glossina morsitans* Strains.

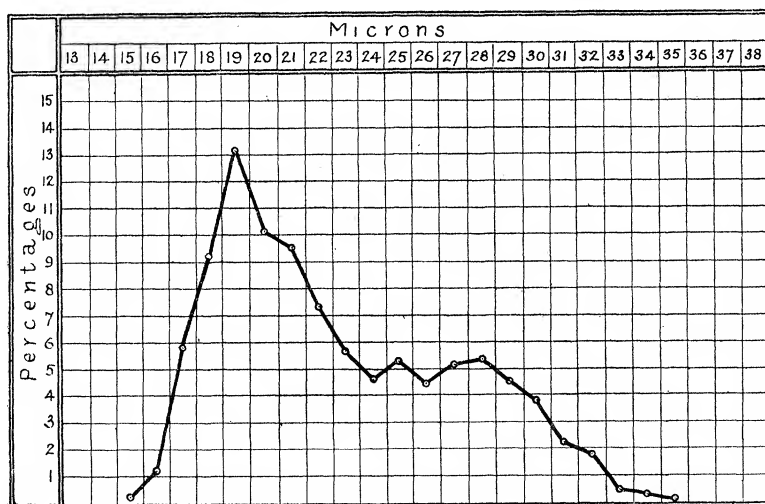


Table XVIII.—Comparison of the Percentage of Posterior-nuclear Forms found among the Short and Stumpy Varieties of the Trypanosome of the five Wild *Glossina morsitans* Strains.

Date.	Experiment No.	Animal.	Percentage among short and stumpy forms.
1912	523	Monkey	12·3
1912	542	Dog	28·9
1912	551	„	12·8
1912	595	„	4·5
1912	602	„	4·2
Average			12·5

Comparison of the Human Strain with the Wild-game and Wild Glossina morsitans Strains.

Table XIX.—Average Length of the Trypanosome of the Human, Wild-game, and Wild *Glossina morsitans* Strains.

Strain.	Number of trypanosomes measured.	Animal.	In microns.		
			Average length.	Maximum length.	Minimum length.
Human	3600	Rat	24·2	38·0	15·0
Wild-game	2500	„	22·6	35·0	15·0
Wild <i>G. morsitans</i>	2500	„	22·6	35·0	15·0

It is remarkable that the Wild-game strains and the Wild *Glossina morsitans* strains should come out exactly alike. Why the Human strains differ to some extent from the other two cannot at present be explained.

The curves of the Wild-game strains and the Wild *Glossina morsitans* strains are so similar that there can be little doubt the same species of trypanosome is being dealt with. The Human strain differs so much, that the suspicion must present itself that in some way more than one species is being dealt with. The three Human strains which differ most from the Wild-game and Wild *Glossina morsitans* type are Stephens and Fantham's case of Armstrong, in Liverpool; Strain I, Mkanyanga; and Strain III, Chituluka. On examining these three strains, however, from every possible point of view, nothing, except the difference in the type of curve, can be found to justify this suspicion.

CHART 7.—Curves representing the Distribution, by Percentages, of 3600 Individuals of the Trypanosome of the Human Strains, 2500 of the Wild-game Strains, and 2500 of the Wild *Glossina morsitans* Strains.

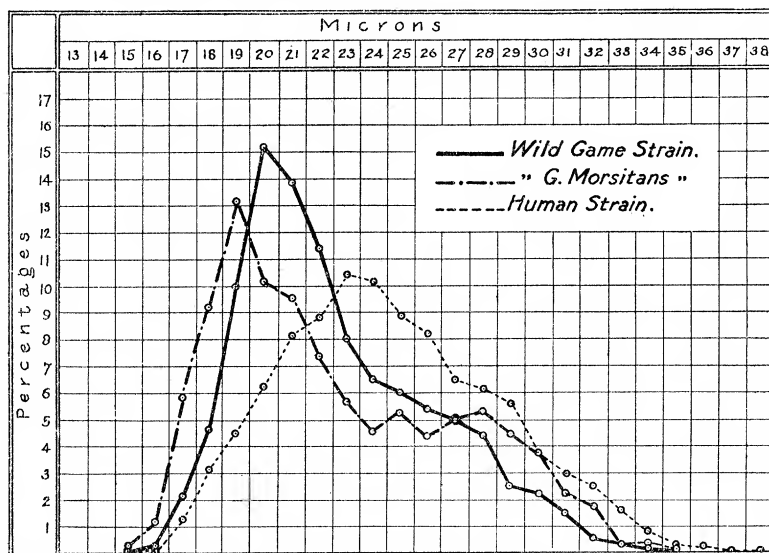


Table XX.—Percentages of Posterior-nuclear Forms found among the Short and Stumpy Varieties of the Trypanosome of the Human, Wild-game, and Wild *Glossina morsitans* Strains.

Date.	Strain.	Percentages.		
		Average.	Maximum.	Minimum.
1912	Human	21.1	52.0	2.0
1912	Wild-game	26.2	33.4	8.4
1912	Wild <i>G. morsitans</i>	12.5	28.9	4.2

Conclusions.

1. The five Wild *Glossina morsitans* strains resemble each other closely, and all belong to the same species of trypanosome.
2. The Wild *Glossina morsitans* strain, the Human strain, and the Wild-game strain, belong to the same species.
3. This species is *T. rhodesiense* (Stephens and Fantham).
4. It is probable that *T. rhodesiense* and *T. brucei* (Plimmer and Bradford) are identical.